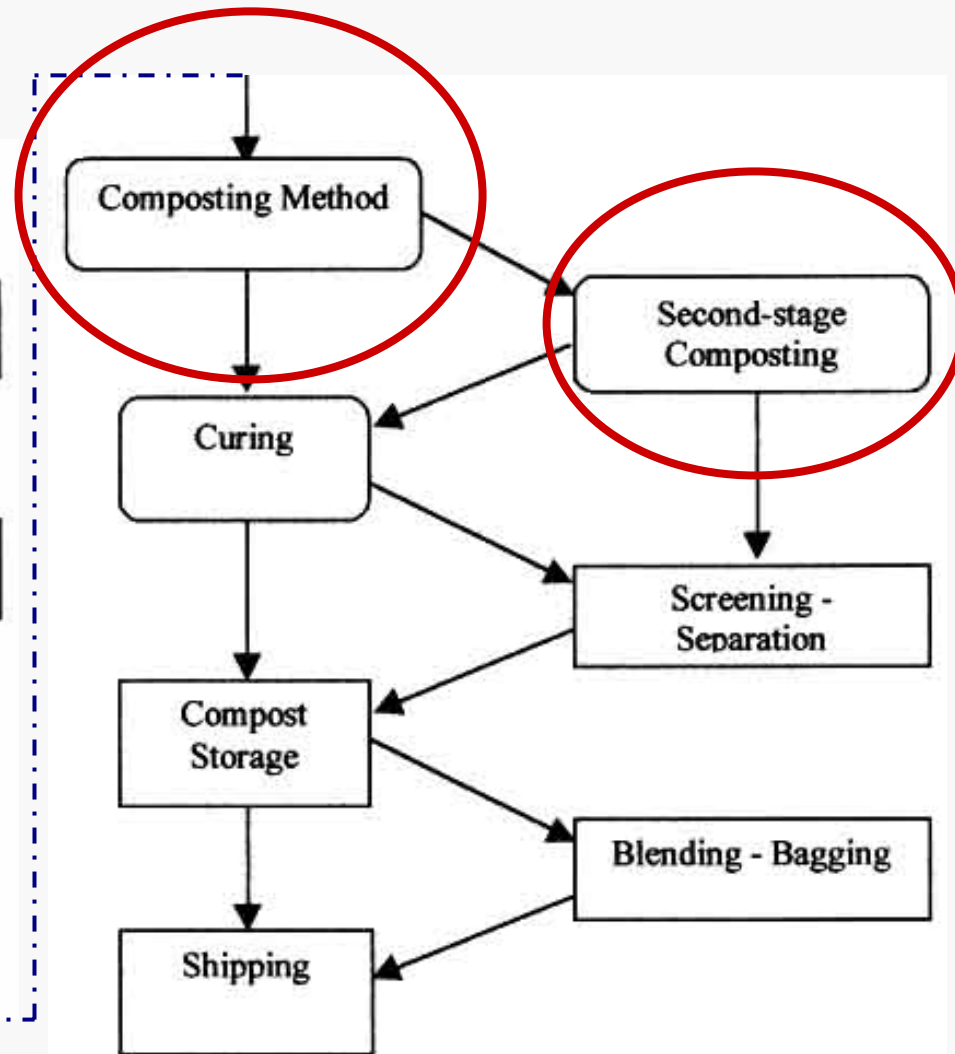
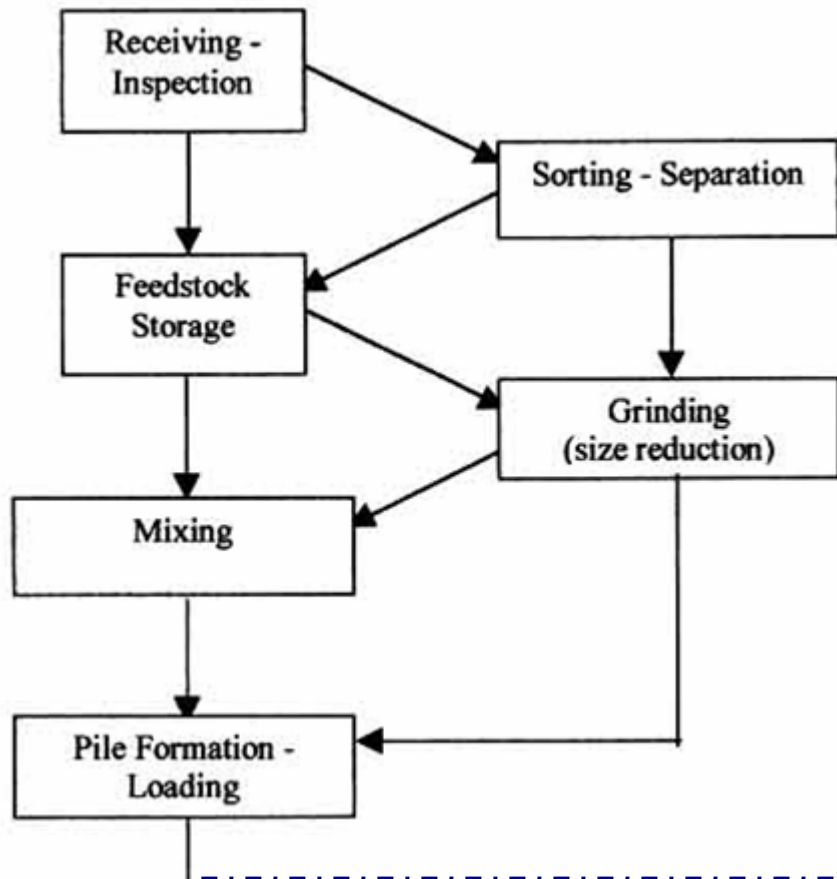


Making Good Compost

Bob Rynk

WORKS Advanced Compost Training

March 28, 2006



Composting Methods

Categories

- Passively aerated – Static
- Passively aerated – Turned (agitated)
- Forced aerated – Static
- Forced aerated – Turned (agitated)
- Contained or “in-vessel”

Passive/Static



Passive piles

- Incidental to infrequent turning
- Combine with another composting stage
- Low labor
- Inexpensive equipment (loaders, excavators)
- Largely anaerobic
- Slow – years
- Little process control
- Odors – can be very bad but some say better

Passive piles

Limited to:

- slowly degradable and/or porous feedstocks
- no hurry situations
- particular settings – isolated, farms

Works well:

- in the above cases
- for mortalities (because of encasement)



Passive/Turned



PS: Joe Cody, Purina Mills



Turned windrows



Turning mechanisms



PS: Herb Brodie



PS: Nadine Davitt,







Windrows

- Simple, easily started and managed
- Little or no engineering
- No utilities necessary
- Turning strategy flexible and changeable – daily, weekly, monthly
- Limited process control
- Temperature and time main process variables
- Some composters monitor O₂ or CO₂ also

Windrows

- Moderate composting time – months to year, depending on turning schedule
- Large area
- Materials handling
- Labor and fuel relatively substantial
- Moderately expensive equipment
- Equipment wear and maintenance
- Odors difficult to control, periodic intense emissions

Windrows

Limited to:

- sites that are not severely restricted by space or not very sensitive to odors or emissions
- locations that do not require a cover
- all but the most troublesome feedstocks

Works well:

- for feedstocks that do not need amending (yard trimmings, most manure)
- for large sites that are well buffered (e.g. farms)
- for start-ups and trials

“Trapezoidal Piles”



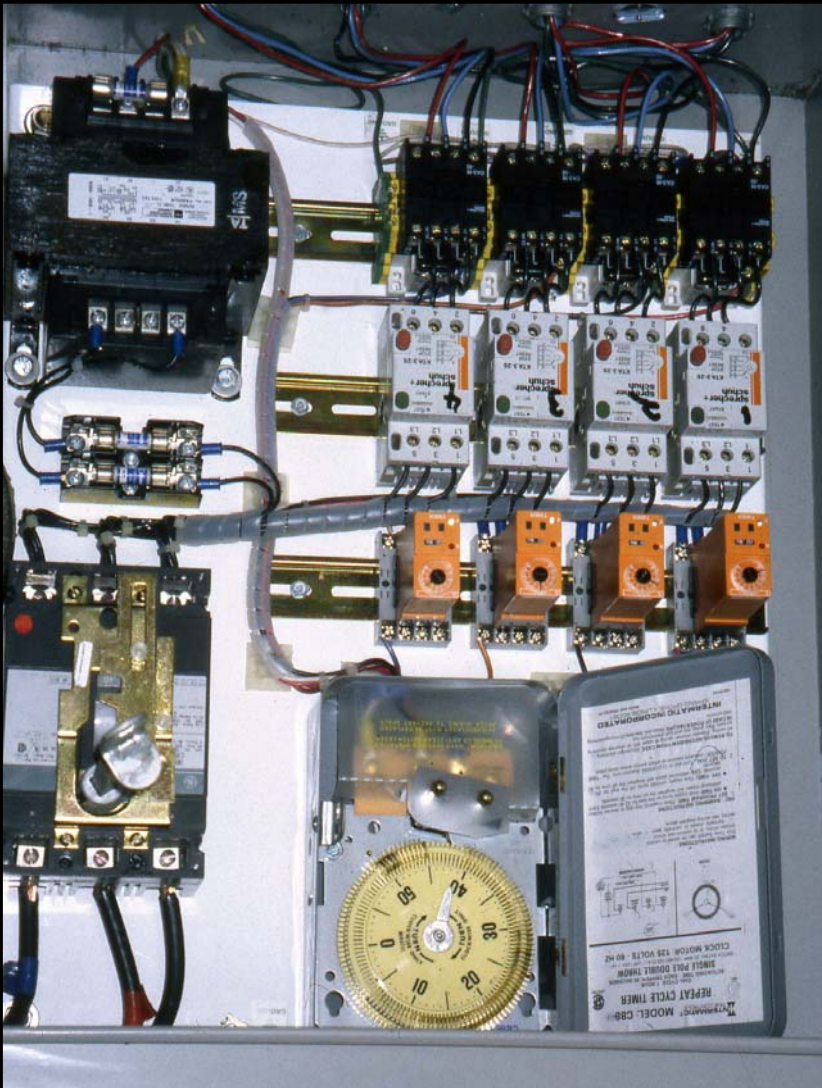


PS: Ag-Bag Environmental



Aerated/Static





Aerated Piles

- Mainly aerobic
- Many aeration schemes -- positive or negative aeration, or both
- Moderate to good process control
- Temperature and time key aeration variables
- Moderate to short composting time, depending on feedstocks – weeks to months
- Difficult to adjust distribute added moisture
- Air channeling a concern
- Inconsistent conditions in pile and process
“stagnation” possible -- due to static nature

Aerated Piles

- Low area requirement, easily covered
- Relatively low labor
- Requires engineering, but can be simple
- Requires electricity (or engine-driven blower)
- Materials handling
- Usually requires mixing with amendments that provide structure
- Odor control – lower generation, can capture exhaust (negative mode) or building air

Aerated Piles

Limited to:

- All but the most severely restricted sites
- Situations where appropriate amendments are available

Works well:

- particularly for biosolids, historically
- for most feedstocks, especially where odor control or an enclosure is advantageous

Aerated/Agitated



PS: Charles Henry



PS: Lew Naylor



Agitated beds



PS: Karin Grobe



Agitated beds

- Several aeration, containment and materials movement option
- Mainly aerobic
- Can eliminate aeration in some cases
- Can be staged
- Good process control
- Built in materials handling/movement
- Some constraints due to straight line materials flow
- Short to moderate composting time, depending on feedstocks -- weeks

Agitated beds

- Overcomes air channeling, inconsistent conditions in pile and process “stagnation”
- Low area requirement, easily covered
- Low labor, but skilled operators
- Separates operators from turning environment
- Requires engineering
- Requires electricity, plus
- Often requires mixing with amendments that provide porosity
- Odor control – lower generation, can capture exhaust (negative mode) or building air

Agitated beds

Limited to:

- projects with a generous budget
- where skilled staff are available

Works well:

- for most feedstocks, especially where odor control or an enclosure is advantageous
- where process and odor control are advantageous
- As the first stage in a multistage system

Contained/In-Vessel







PS: Michele Young



*Courtesy of :
Willson Brown Associates,
US Patent No. 09/463148*

Contained/In-vessel

- You BUY it, they support it
- Many systems, configurations and options – difficult to generalize (but I will anyway)
- Wide range in regard to scale (some modular)
- Many combinations of aeration, agitation and materials handling
- Mainly aerobic
- Usually, very good process control
- Multiple control variables used
- Air recirculation possible in some cases
- Short to “not as short” composting time, depending on feedstocks – days (?) to weeks

Contained/In-vessel

- Overcome moisture distribution and stagnation problems within materials
- Usually require mixing with amendments that provide structure
- Low to moderate labor, but skilled/trained operator
- Some to much engineering
- Require electricity, plus
- Low area requirement, self-contained
- Very good odor and emissions control – low generation, emissions contained

Contained/In-vessel

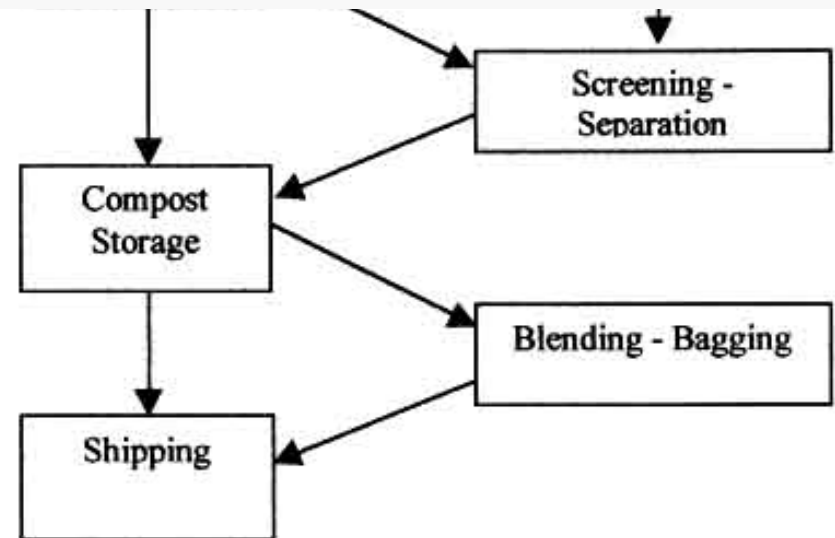
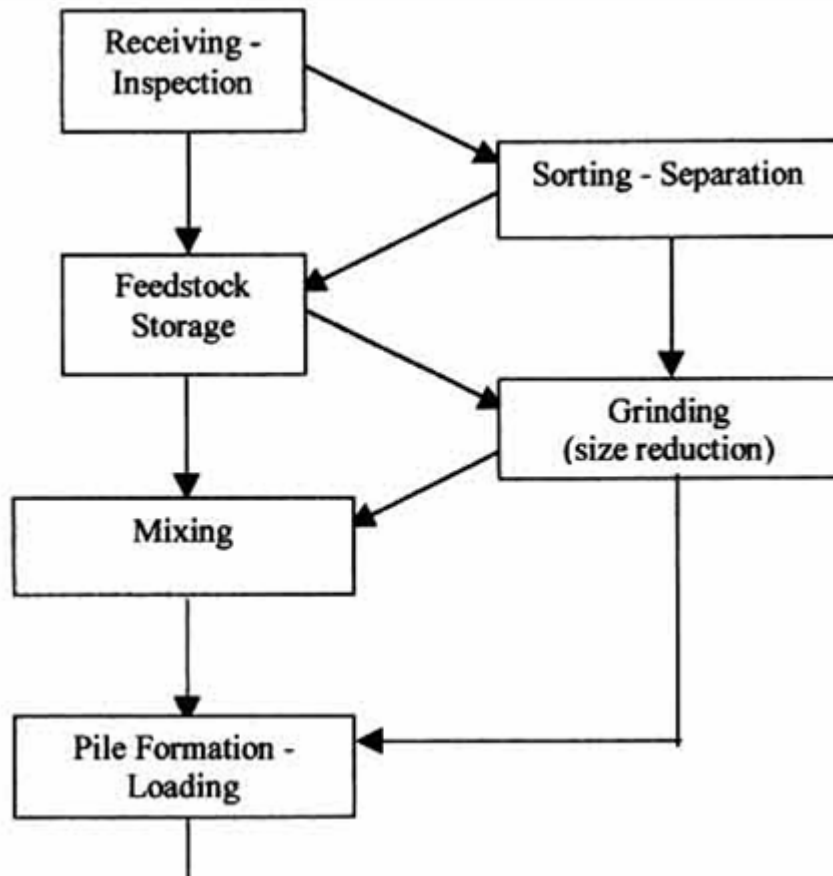
Limited to:

- projects with a generous budget
- where skilled staff available

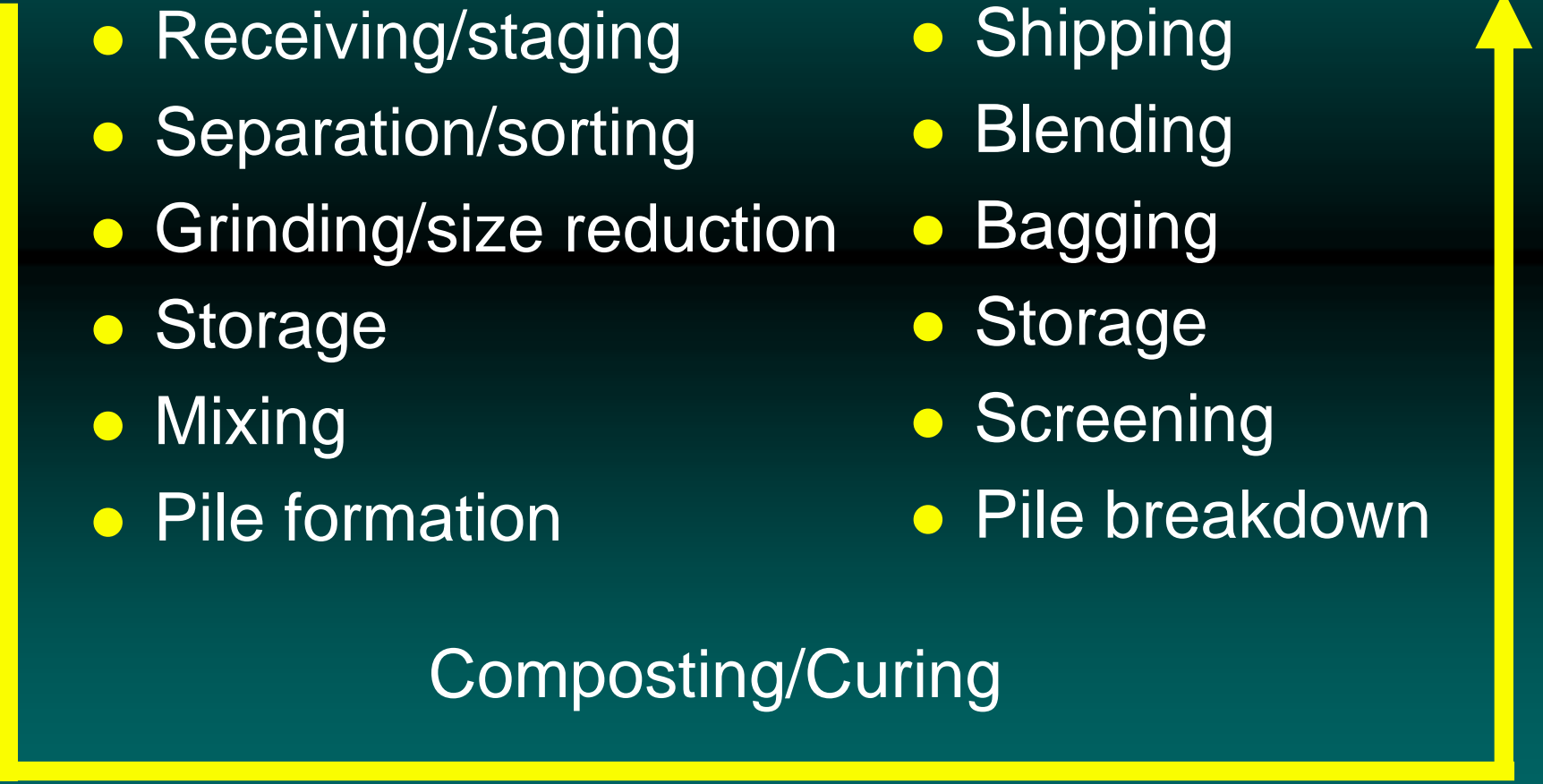
Works well:

- as first stage of multi-stage system
- for on-site composting in commercial, industrial, residential settings
- in tight spots
- in odor/emissions sensitive situations
- for difficult feedstocks

Supporting Operations



Possible Supporting Operations

- 
- Receiving/staging
 - Separation/sorting
 - Grinding/size reduction
 - Storage
 - Mixing
 - Pile formation
 - Shipping
 - Blending
 - Bagging
 - Storage
 - Screening
 - Pile breakdown

Composting/Curing









*Photo credit: Darrin Harn,
Kuhn Knight Indus.*



- Tub grinders
- Horizontal-feed hammer mills
- Chippers
- Shear shredders















Management Issues



Temperature



Moisture



O_2/CO_2





Photo Source (PS): NRAES

Odor Management

- You will spend more time addressing odors than any other nuisance problem
- You will worry about odors more than anything else ... (except money)
- Odor control and management is critical, crucial, essential



PS: Doug Pinkerton, BioCycle

Topography Matters

- Air follows the path of least resistance
- Odorous air can drain downhill
(it doesn't take much of a hill)



Keep Good Records



Weather Matters



Nasal Ranger

*Photo Source:
Michael McGinley,
St. Croix Sensory, Inc.*



www.nasalranger.com

www.fivesenses.com

Barnebey-Cheney Scentometer



Photo Source: Michael McGinley, St. Croix Sensory, Inc.





Odor Control & Management

- A good isolated site
- Good housekeeping
- Prompt handling of feedstocks
- Sensible process management
- Contain or enclose the process
- Capture and treat foul air (e.g. biofilters)
- Be a good neighbor ... generally

Be a Good Neighbor and Citizen



Comments?

Questions?